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Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

Canada

Ce rapport est aussi disponible en français.

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES OF THE GROUNDING THE SOVIET OBO "IVAN TEVOSYAN" IN THE APPROACHES TO THE QUEBEC PORT OF PORT-CARTIER ON OCTOBER 29, 1987

REPORT No. 504

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REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES OF THE GROUNDING OF THE SOVIET OBO "IVAN TEVOSYAN" IN THE IN THE APPROACHES TO THE QUEBEC PORT OF PORT-CARTIER ON OCTOBER 29, 1987.

Particulars of the vessel

Name	"IVAN TEVOSYAN"
Official Number	M 37573
Nationality	USSR
Port of Registry	Novorossisk
Call Sign	UFIN
Gross Tonnage	62,860.58
Net Tonnage	38,371.77
Length	258.65 m
Breadth	39.06 m
Depth	21.40 m
Draught (at the time of the incident)	forward 9.65 m Aft 12.50 m
Type	Ore/bulk/oil (OBO)
Construction	In 1982, steel, at Nicolaiefsk, USSR
Propulsion	One diesel engine, 9 cylinders, sulzer, 2SA 21,100 BHP (15,520 kW) driving a fixed pitched propeller
Cargo	62,456.16 t of wheat
Crew	40
Owner	Novorossiysk Shipping Company Novorossisk, USSR
Canadian Agents	Morflot Freightliners Ltd. Montreal
Classification	USSR Register of Shipping

Navigation Equipment

Radar 1	USSR, range 1 to 64 M, 10 cm
Radar 2	USSR, range 1 to 64 M, 3 cm
Radar (repeater)	Horten, N&R, Databridge-7, Automatic Radar Plotting Aid (ARPA)
Radio Direction Finder	USSR
Sounding Machine	USSR, one repeater and one plotter
Decca	USSR
Loran A & C	USSR
Sat-Nav	Magnavox, MX 1102
VHF 1	USSR, REJD-1
VHF 2	USSR, REJD-1
SSB	One
Gyro Compass (2)	Vega, USSR
Magnetic compass	USSR
Autopilot	One
Main Engine Data Logger	One
Course Recorder	One
Rudder Indicator	One on bridge and one on each bridge wing

Note: The pilot used a portable VHF radiotelephone for the manoeuvres.

Description of the Vessel

The "IVAN TEVOSYAN" is an ore carrier/bulk carrier/oil tanker (OBO) with 9 central holds and 10 side tanks. It also has 2 forepeaks, one over the other, and 2 fuel tanks. The pump room is located aft of the holds. The engine-room and accommodation are at the stern. The main engine is control-

led via a bridge control system (see Appendix I).

Certificates

All certificates were issued by the USSR Register of Shipping classification society.

1.	Load Line Certificate	Issued in Novorossisk on September 30, 1986, valid until September 20, 1991.
2.	Cargo Ship Safety Radio Telegraphy Certificate	Issued in Novorossisk on August 27, 1987, valid until August 27, 1988.
3.	Cargo Ship Safety Construction Certificate	Issued in Novorossisk on September 30, 1986, valid until September 30, 1990.
4.	Cargo Ship Safety Equipment Certificate	Issued in Novorossisk on September 30 1986, valid until September 30, 1988.

Note: In this report, Eastern Daylight Savings Time (UTC minus 4 hours) is used to indicate time up to October 30, 1987 inclusive. After that date, Eastern Standard Time (UTC minus 5 hours) is used to indicate time.

Background

On October 29, 1987, the "IVAN TEVOSYAN" ran aground in the approaches east of the port entrance during manoeuvres to berth at wharf No. 3 in order to top up a cargo of wheat bound for the Soviet Union.

The vessel was assisted by a tug and guided by a pilot. Fog had reduced visibility to less than 2 cables. The "IVAN TEVOSYAN" was refloated immediately and guided to an anchorage berth.

The vessel suffered damage to the bottom shell plating, and temporary repairs of approximately $45,000 were made in Pointe-Noire, Quebec. The vessel returned to Port-Cartier to complete loading before continuing her voyage to the Soviet Union.

There were no injuries or pollution in the incident.

Narrative

On October 22, 1987, the "IVAN TEVOSYAN" arrived in Quebec City from Cuba and a partial cargo of 62,465 t Canadian wheat was loaded. On October 24, the ship sailed from Quebec City and dropped anchor the next day off Port-Cartier.

At 0615 on October 29, the"IVAN TEVOSYAN" received a message from the Compagnie Minière Québec Cartier agent that the pilot would come aboard at 0700. The first mate on watch saw to the preparation of the vessel. The master and the duty engineer were notified of the departure.

The whistle, telegraph and lights were checked. About 0635, the boatswain and the pumpman began weighing anchor from the forecastle. The master arrived on the bridge.

The two steering gear engines and the standby engine were checked. The starboard engine was started up at 0640, and the first mate checked the operation of the steering gear.

At 0644, the clock at the telegraph in the engine room was synchronized with the clock on the bridge and the gyro repeater compasses were verified. The gyro compass was not in error.

At 0655, the anchor was hauled up, the anchor lights turned off and the navigation lights turned on. At 0700, the "IVAN TEVOSYAN" left anchoring berth "D" off Port-Cartier. The orders "slow speed ahead" and course 120°(G) were issued to the main engine-room and to the helm, respectively.

A visibility of 5-6 cables was recorded in the log book.

At 0706, the "IVAN TEVOSYAN" slowly initiated a course change to starboard and headed for the mid-channel buoy. Since ships were anchored in the vicinity, the main engine was stopped 0712, but the order "dead slow speed ahead" was again given at 0716. Meanwhile, the pilot completed an assignment in the port at 0715 and boarded the tug "VACHON".

Around 0730, the "IVAN TEVOSYAN" met the tug "VACHON" south of the mid-channel buoy. The pilot came aboard and was escorted to the bridge by the third officer.

Visibility was then down to 4 cables with a light easterly wind and a 3-4 m swell from the ESE.

The crew went to their mooring stations. The second

navigating officer left the bridge and joined the boatswain and the pumpman on the forecastle. The second cargo officer was assigned to the stern of the ship. The master, the first mate, the third officer, a helmsman, the pilot and an apprentice master were present in the wheel-house.

The pilot discussed a few details of the vessel with the navigating personnel, asked the master to confirm his arrival on board with the Les Escoumins Vessel Traffic Services Centre, and had the Application to Go Alongside form completed for Port-Cartier.

After rounding the mid-channel buoy, the pilot had the ship steered toward the breakwater east of the port entrance. From 0749 to 0756, the course recorder indicated a course of 028°(G). The master requested an explanation since the channel alignment was 016½°(V). The pilot replied that he had to compensate for the west-flowing current. He estimated the speed of the ship at 3 kn. At the pilot's request, the tug "BROCHU" reported a visibility of 4 cables inside the port.

At 0757, the main engine was stopped and the vessel steered on her way. Approximately one nautical mile from the entrance, the pilot asked the captain to change course to port at 018°(G) in order to align the heading marker of the non-stabilized radar with the west side of the mole. The course recorder graph indicated that the vessel steadied on course 019°(G) at 0759. The tug "VACHON" made fast forward at 0800 and followed the "IVAN TEVOSYAN" on her port side.

In positioning the vessel using the two cells at the port entrance, the pilot found that the vessel was drifting too far west. He thus ordered the ship's course set to 025°(G) 3/4 mile from the port entrance. The ship stabilized on course 026°(G) at 0801. The pilot changed the radar range scale from 4 M to 1 M.

At the request of the pilot, the "BROCHU" again indicated that visibility inside the port was holding at 4 cables. It was virtually nil outside the port. Bearings were still being taken by radar. Meanwhile, the "VACHON" asked the pilot if he could see land; he replied that the harbour installations were not yet visible from the bridge of the "IVAN TEVOSYAN". The "VACHON" also pointed out that the "IVAN TEVOSYAN" was heading too far east. From several radar observations, the master also noticed that the ship was heading for the breakwater east of the port entrance.

The pilot was advised that the "IVAN TEVOSYAN" log indicated a speed of 4.8 kn. The pilot began seeing the

harbour installations a few seconds later and, at 0803, the main engine was set to "full speed astern". The pilot called for both anchors to be let go to three shackles each. Additional power was ordered from the bridge at 0804 and the main engine speed astern was increased to 105 RPM.

The ship maintained course 025°(G) aligned with the west side of the breakwater until 0805. Seeing that he could not bring the ship back into the channel, the pilot attempted to steer between the breakwater and the mole. The helm and the "VACHON" were ordered to port to 020°(G) and to pull westward, respectively. At 0806, the "IVAN TEVOSYAN" swung to 021°(G), but then began to swing to starboard because of the transverse thrust of the propeller going astern. The tug "BROCHU" was waiting near the port entrance; she was also requested to push the starboard bow of the vessel westward.

Dropping both anchors did not seem to have any effect on reducing the speed of the "IVAN TEVOSYAN". At approximately 0807, the "IVAN TEVOSYAN" ran aground in 50°01.6'N, 066°46.8'W, i.e. 100 m SSW of the breakwater. The grounding was only momentary since the red log light came on immediately to indicate that the ship was going astern. The vessel continued to swing to starboard until 0809, when she reached a heading of 043°(G). The crew started weighing anchor and the main engine was gradually throttled back until the vessel was back in the entrance channel.

At 0813, the second navigating officer detected air escaping from the ventilation pipe of tank No. 3, and then of fuel tank No. 1. The leaks were reported to the bridge and sounding of all tanks was begun. The starboard and port anchors were aweigh at 0815 and 0818, respectively.

The swing to port was completed at 0830. The "IVAN TEVOSYAN" headed for an anchorage berth and again dropped anchor in position 55°00.3'N, 66°45.2'W at 1031 on October 29, 1987.

The Les Escoumins Vessel Traffic Services Centre and the Administration of the Compagnie Minière Québec Cartier were notified of the incident at 0935. During the day, a Canadian Coast Guard marine surveyor came aboard and, after inspecting the damage issued an Interdiction to Proceed with the condition that the "IVAN TEVOSYAN"could take shelter in the Sept-Îles Bay but not put to sea.

On October 30, an underwater examination revealed damage to the starboard bottom shell plating in way of the fore peak, to fuel tank No. 1 and tank No. 3.

The "IVAN TEVOSYAN" weighed anchor at Port-Cartier at 0829 on November 1, headed for Sept-Îles and went alongside the Pointe-Noire wharf at 1139. Temporary repairs were carried out and, on November 6, a marine surveyor from the classification society issued an Interim Certificate of Class. The ship sailed from Pointe-Noire at 1100 on November 8, and dropped anchor off Port-Cartier at 1355.

On November 20, the "IVAN TEVOSYAN" weighed anchor and went alongside berth No. 3 at Port-Cartier at 0629. Loading was completed on November 21. A marine surveyor from Ship Safety Coast Guard issued a Certificate of Fitness to Proceed. The "IVAN TEVOSYAN" sailed from Port-Cartier at 1345 and headed for Novorossisk, USSR with a total cargo of 97,514 of wheat.

Analysis

1. Port characteristics

The Port-Cartier harbour is an artificial port dug out of rock and belonging to the Compagnie Minière Québec Cartier.

The port is 15.2 m deep with a rock bottom. The access channel was dredged to a depth of 16.6 m over a width of 122 m. The port entrance is 91 m wide between obstacles. The eastern and western boundaries of the port entrance are marked by a mole and a cell respectively. An unnamed breakwater one cable east of the mole is also referred to several times in this report.

2. Pilotage

Pilot and tug services are mandatory in Port-Cartier, except in rare cases of home-trade vessels not exceeding 115.8 m (380 ft) in length. However, it must be noted that no guidelines for vessel movements in restricted visibility have been issued by the Port Authority. The decision to carry out an assignment is left to the discretion of the pilot. The pilots of the Compagnie Minière Québec Cartier board vessels approximately one mile from the port entrance. Two 4,500 HP tugs, the "VACHON" and the "BROCHU", are available to port users.

The International Conference on Training and Certification of Seafarers, 1978 and the IMO Recommended Code of Nautical Procedures and Practices stipulate, under the heading "Basic Principles to be Observed in Keeping a Navigational Watch", that:

10) Navigation with pilot embarked

> Despite the duties and obligations of a pilot, his presence on board does not relieve the master or officer in charge of the watch from their duties and obligations for the safety of the ship. The master and the pilot shall exchange information regarding navigation procedures, local conditions and the ship;s characteristics. The master and the officer of the watch shall co-operate closely with the pilot and maintain an accurate check of the ship's position and movement.

The pilot on the "IVAN TEVOSYAN" piloted the vessel throughout the approach. However, the main engine was put astern at 0804 and the course heading changed to port at the captain's insistence.

The Port-Cartier pilots alternate every 2 weeks. During each work period, pilots work 12 hours and have 12 hours off every 24 hours.

Occasionally they work two consecutive 12-hour shifts. It goes without saying that they then have two 12-hour shifts off. The pilots also have a rest area and between assignments their food is provided by the company.

The pilot of the "IVAN TEVOSYAN" was on his forth assignment since midnight. He had completed his previous assignment at 0715 on the day of the casualty. He had not worked the previous day, had rested from 2000 to 0100 before starting work as well as a few hours between assignments.

3. Mooring of tugs

It is common practice in Port-Cartier to use ship's ropes to make fast the tug. Two ropes are usually passed from the vessel to each tug. The "IVAN TEVOSYAN" had passed two ropes to the tug "VACHON" through the vessel's forward Panama lead. The mooring of the "VACHON" to the "IVAN TEVOSYAN" was completed around 0800 at a distance of approximately 7 cables from the port entrance.

The ropes had been prepared to moor the "BROCHU" at the stern of the "IVAN TEVOSYAN" but, due to the weather conditions, the "BROCHU" remained at the port entrance.

In restricted visibility, the pilots' normal practice is to moor one tug to the vessel to assist with the approach manoeuvres, and to have another tug at the port entrance to advise the pilot on the visibility conditions inside the port.

4. **Communications**

The pilot and the tug masters are francophones; all communication between them was conducted in French by VHF radiotelephone.

Although the master, the officers and the helmsman in the wheel-house of the "IVAN TEVOSYAN" were Russian, all but the helmsman understood English. Steering orders and course changes were given in English by the pilot to the master and repeated in Russian by the master to the helmsman. The pilot gave the main engine commands, which were carried out by the master. Based on the evidence, there was no apparent problem with comprehension.

Communications between the ship and the Vessel Traffic Services Centre (VTS) were conducted via the VHF radiotelephones on the "IVAN TEVOSYAN". The pilot communicated with the tugs using a portable VHF radiotelephone.

The tugs kept a radio watch on frequencies 7B adn 12 of the VHF radiotelephone, i.e. at the respective frequencies of the tugs and pilots and of the Port-Cartier station.

The grounding was reported by the pilot to the Port-Cartier station, and by the master of the "IVAN TEVOSYAN" to VTS.

One of the first mate's duties during manoeuvres was to verify that the helmsman was obeying the steering orders correctly.

5. **Wheel-house layout**

There is a gyro repeater compass forward of the helm, and a three sided helm indicator with the three repeaters on the deckhead at the centre of the wheel-house. However, due to the width of the bridge and the reflection of light on the screen, one must stand close to the helm indicator to see the helm changes clearly.

The telegraph and the radar repeater (ARPA) are situated

to starboard of the helm, and one radar (3 cm) is located at the extreme starboard side of the bridge. The second radar (10 cm) is on the starboard side of the chart table at the after end of the wheel-house.

The following people were present on the bridge during the approach manoeuvres of the "IVAN TEVOSYAN": the helmsman at the wheel and the first mate at his side, the master at the telegraph and radar repeater, the pilot to the right of the master at the 3 cm radar, the third officer at the chart table and the 10 cm radar, and an apprentice master in an observer role.

6. Shore navigation aids

The Port-Cartier light range is aligned 016.5°(T) and is situated near the NE end of the port.

A mid-channel light/bell buoy marked "Port-Cartier" was moored approximately 1.55 mile SSW of the port entrance.

It must be noted that the pilot used the alignment of the two cells which are parallel to the channel alignment and situated at the western side of the port entrance to evaluate the ship's position.

7. Shipborne navigation aids

It was reported that all operational navigational equipment was functioning satisfactorily prior to the grounding.

The gyro compass had no error and the course repeater at the helm read the same as the main gyro compass.

It must be noted that a crew member, specialized in radar maintenance was in charge of the performance of the radars. All were operating well. The radars were used on the 4M, 2M and 1M ranges.

The course recorder graph showed the course changes versus time, but did not also include a plot of the helm movements. The course recorder timer showed 3 minutes of error per 4 hour watch. Any error in time scale over the period of the manoeuvres analyzed would have been therefore less than one minute. The courses plotted were synchronized with the gyro compass.

The main engine data logger broke down a few minutes before the grounding. The manoeuvering speeds for the main engine had been recorded in a log-book.

The sounding machine repeater had been switched on but, since the plotter cannot work simultaneously with the repeater, only the repeater was in use.

8. Sequence of events

All events described in this Analysis occurred on Eastern Daylight Saving Time (UTC - 4 hours). However, Atlantic Daylight Saving Time (UTC minus 3 hours) was used aboard the "IVAN TEVOSYAN".

The following are the main events that occurred from the moment the "IVAN TEVOSYAN" weighed anchor at the anchorage; evidence was collected from various sources and the times are indicated in Eastern Daylight Saving Time.

Note: Approximate times are indicated by an asterick.

0615 - the "IVAN TEVOSYAN" was advised by the Compagnie Minière Québec Cartier agent that the pilot would come aboard at 0700.

0635 - started weighing anchor

0640 - steering gear checked

0655 - anchor aweigh
- anchor lights turned off and navigation lights turned on

0700 - "slow speed ahead" order given for the main engine, set course to 120°(G)

0706 - vessel slowly began altering course to starboard to head for the mid-channel buoy

0712 - main engine stopped due to traffic

0716 - "dead slow speed ahead" order given

0730 - pilot boarded abeam of the mid-channel buoy
- vessel steering on the point to the east of the port entrance

0749 - vessel steering on course 028°(G)

0757 - main engine stopped

* - course altered to 018°(G)

* - vessel about 1M from the port entrance

0759 - steadied up on 019°(G)

0800 - tug "VACHON" made fast forward to the "IVAN TEVOSYAN"

0801 - steadied up on 026°(G)
- vessel about 3/4 M from the port entrance
* - change of radar range

* 0802 - Warning by the bridge personnel of the tug "VACHON" that the vessel is heading too far to the east
* - the log of the "IVAN TEVOSYAN" indicates a speed of 4.8 kn

* 0803 - first visual contact with harbour installations
0803 - main engine rung "full speed astern"

0804 - main engine revolutions astern increased to 105 RPM

0805 - both anchors let go
- course change from 025°(G) to 020° (G) ordered
- the "VACHON" was ordered to pull to port

0806 - the "IVAN TEVOSYAN" swings to 021°(G)
- due to the transyerse thrust of the propeller going astern, the vessel began to swing to starboard
- tug "BROCHU" waiting near the port entrance was requested to push the ship's starboard bow westward

0807 - the "IVAN TEVOSYAN" ran aground at 50°01.6'N, 066°46.8'W
- red speed log light came on to indicate that the ship was going astern

0809 - vessel swings to starboard to 043°(G)
- started weighing anchors
- main engine set to "half speed astern"

0810 - main engine set to "slow speed astern", then to "stop"
- vessel returned to the entrance channel

0813 - first indication that the vessel is making water

0815 - starboard anchor aweigh

0818 - port anchor aweigh

0830 - the "IVAN TEVOSYAN" set course for an anchorage berth

0844 - tugs released

0931 - starboard anchor let go in 55°00.3'N by 066°45.25'W

0935 - Les Escoumins Vessel Traffic Services Centre notified of the damage

9. **Weather conditions and forecast**

The automatic weather station at Pointe-des-Monts records data every hour for, among other things, wind speed and direction, air temperature and visibility.

The Pointe-des-Monts automatic weather station recorded the following weather conditions for October 29, 1987:

time (UTC)	visibility (miles)	temperature (Celsius)	wind (direction)	wind (knots)
1000	1.6	5°	250°	10
1100	0.5	4°	250°	17
1200	0.4	4°	240°	14
1300	0.6	4°	230°	14
1400	3.5	5°	270°	14

The following weather conditions were recorded at the Sept-Îles airport weather station for October 29, 1987:

time (UTC)	visibility (miles)	sky	wind (direction)	wind (knots)
1000	8	overcast	070°	13
1052	8	overcast/rain	070°	13
1145	4	rain/fog	080°	7
1200	4	rain/fog	080°	10
1243	1	rain/fog	090°	5
1337	1/2	rain/fog	120°	5
1400	1/8	fog	130°	5

Note: 1. The Pointe-des-Monts automatic weather station and the Sept-Îles aerometeorological station are located approximately 49 M southwest and 24 M east of Port-Cartier, respectively.

2. The grounding occurred at approximately 0807 Eastern Daylight Savings Time (Z+4) or 1207 (UTC)

The pilot and crew of the "IVAN TEVOSYAN" confirmed the poor visibility. Based on the evidence, visibility at the anchoring berth at 0600 before weighing anchor was 5-6 cables. When the vessel passed the mid-channel buoy at 0730, visibility was only 4 cables. Around 0800, it had deteriorated to less than one cable outside the port a few minutes prior to the grounding.

The wind apparently dropped some time before the grounding, but there was still at 3-4 m ESE swell.

10. Tides

The tidal differences for Port-Cartier are calculated using Sept-Îles as a reference, and are given in Volume 3 of the Canadian Tide and Current Tables.

On October 29, 1987, high tide at Port-Cartier was forecast for 0718 with a height of 1.8 m above the chart datum and a 1 m tidal range.

The "IVAN TEVOSYAN" ran aground at approximately 0807, i.e. 49 minutes after slack water. The tide had dropped 1.6 m above chart datum.

11. Grounding location

The "IVAN TEVOSYAN" had a forward draught of 9.65 m before running aground. Since the height of the tide around 0806 was 1.6 m, the ship would have hit bottom in approximately 8.05 m of water above the chart datum.

Based on the evidence, the vessel would have run aground 40 to 60 m off the breakwater. This would confirm that the grounding occurred between the 5 m and 10 m level lines.

An approximate position estimated by the navigating personnel and the pilot, placing the grounding at 50°01.64'N by 066°46.86'W, was not recorded in the log-book or on the chart. According to the navigating personnel of the "IVAN TEVOSYAN", the vessel passed over her anchors but did not run aground.

12. Manoeuvrability

During the approach manoeuvre, it was noted that the main engine and the auxiliaries were functioning satisfactorily.

The manoeuvering speeds of the "IVAN TEVOSYAN" were as follows:

	light (knots)	loaded (knots)	speed (RPM)
full sea speed ahead	15.5	14.8	122
full speed ahead (manoeuvres)	11.8	10.3	90
half-speed ahead	9.9	9.0	70
slow speed ahead	8.3	7.9	60
dead slow speed ahead	7.2	6.0	50
full speed astern			90
emergency astern			105

As recommended by the manufacturer, only one pump was activated to operate the steering gear. Three steering gear engines, i.e. two alternating and one on standby, could be activated by a remote control switch on the bridge.

Based on the evidence, the "IVAN TEVOSYAN" is a highly manoeuvreable vessel that can easily maintain a course under way at a slow speed. It should be noted that the vessel is not equipped with a bow thrust propeller. The main engine was stopped at 0757 and the vessel steered on her own way until 0803 i.e. some four minutes prior to the grounding.

The pilot and the master did not exchange information regarding stopping distances at various speeds. However, the pilot was familiar with the sister ships of this series of OBO's.

Since the "IVAN TEVOSYAN" is equipped with a right-hand-pitch propeller, the vessel swings to starboard when the main engine is put astern. In order to counter the swing caused by the transverse thrust of the propeller, the rudder must be turned to port. In order to further reduce this swing, the tugs "VACHON" and "BROCHU" were requested to pull and push to port, respectively, around 0805.

13. Speed prior to grounding

From 0716 to 0757, the "IVAN TEVOSYAN" approached the entrance to the port at "dead slow speed ahead". Given the partial loading of the vessel, interpolation between the "dead slow speed ahead" manoeuvering speeds in the light and loaded conditions yields a surface speed of approximately 6.6 kn.

The International Regulations for Preventing Collisions at Sea, 1972, Section 1, Conduct of Vessels in any Condition of Visibility, stipulates in Rule 6 under the heading Safe Speed, that:

> Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to ... be stopped within a distance appropriate to the prevailing circumstances and conditions.

The vessel was steered on her way when the main engine was stopped at 0757 at 0.85 M from the port entrance. However, after the first visual contact with the harbour installations around 0803, the main engine was put astern at a speed of 80 RPM. At the request of the master at 0804, the engine speed astern was increased to 105 RPM.

According to the position of the vessel 0748 and the position of the grounding at 0807, the "IVAN TEVOSYAN" would have covered a distance of 1.625 M in 19 minutes, for a mean speed over the bottom of 5.13 kn.

Rule 6 of the Regulations also stipulates that:

> In determining a speed the following factors shall be among those taken into account:

a) By all vessels:

   i) the state of visibility,

   iii) the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions,

   v) the state of wind, sea and current, and the proximity of navigational hazards;

b) Additionally, by vessels with operational radar:

   i) the characteristics, efficiency and limitations of the radar equipment.

After passing the mid-channel buoy, the pilot would have estimated the ship's speed at approximately 3 kn. However, around 0802, the navigating personnel advised the pilot that the log indicated a surface speed of 4.8 kn. A few minutes prior to the grounding, the tug

"VACHON" advised the pilot that it estimated the speed of both vessels at approximately 3 kn.

A speed of 4 kn at the port entrance is considered normal by the local pilots. However, once inside the port, vessels have a very short distance in which to stop.

14. Navigation

The display of the 10 cm radar was in relative mode, stabilized "north-up"; this radar was used mainly by the third officer to plot the positions on the chart. The ARPA repeater was connected to the 10 cm radar and converted its signals to true motion mode and was mainly used by the master.

The display of the 3 cm radar was changed from true motion to relative "head up" mode by the navigating personnel at the request of the pilot when he came aboard.

At the time of the grounding, the "IVAN TEVOSYAN" was navigating by radar in restricted visibility and was moving at slow speeds in confined waters.

While piloting by radar in confined waters in restricted visibility, it is recommended that a radar navigation technique called "parallel indexing" be used, calculated or planned in advance, by closely following the vessel's position. This technique provides a continuous indication of the position and is very accurate, particularly for shorter ranges, in detecting deviations from the desired course over the bottom.

The International Conference on Training and Certification of Seafarers, 1978, and the IMO Recommended Code of Nautical Procedures and Practices stipulate, under the heading Basic Principles to be Observed in Keeping a Navigational Watch, that:

> 7) Navigational equipment
>
> a) The officer of the watch shall make the most effective use of all navigational equipment at his disposal.
>
> 10) Navigation with pilot embarked
>
> ... The master and officer of the watch shall co-operate closely with the pilot and

maintain an accurate check of the ship's position and movement.

Under the heading Recommendation on Operational Guidance for Officers in Charge of a Navigational Watch, the above-mentioned Code stipulates that:

Radar

15) Whenever radar is in use, the officer of the watch should select an appropriate range scale, observe the display carefully and plot effectively.

16) The officer of the watch should ensure that range scale employed are changed at sufficiently frequent intervals so that echoes are detected as early as possible.

18) The officer of the watch should ensure that plotting or systematic analysis is commenced in ample time.

The pilot used the heading marker on the 000° relative bearing of the radar screen to take the fixes. The range circles were illuminated. The navigating personnel nevertheless advised the pilot of the distance to be covered to the port entrance.

The "head up" relative motion radar display is less suited to "parallel indexing technique" than the "north up" display. This navigation method was not used aboard the "IVAN TEVOSYAN".

When the pilot changed the radar range scale from 4 M to 1 M, the radar range may have been changed too early and the navigational bearings confused.

The third officer plotted a position on the chart at 0805, when the orders to let go the anchors and to change course from 025°(G) to 020°(G) were given; the main engine was already at full speed astern. This position shows that the ship would have been slightly east of the channel alignment. The positions at 0700, 0748 and 0758 plotted on the chart and recorded in the log-book seem to be plausible and corroborate the evidence. However, the position at 0805 plotted on the chart and recorded in the log-book indicates an apparently inaccurate radar bearing and range; a range of 2.2 cables from the breakwater would appear to be more acceptable. Moreover, the positions indicated on the

chart were determined using radar No. 1 (10 cm), a frequency primarily designed for long-range use.

15. **Current**

The document entitled "Monography of Regional Ports in Côte-Nord and Saguenay", Volume 3, published by the Quebec Department of Transportation, states:
(free translation)

> Currents vary in depth in the approach channel to the harbour entrance and pilots must take certain precautions.

Based on the evidence, the flood current flows to the northwest and the ebb current to the northeast.

After passing the mid-channel buoy, the ship was steered on 028°(G) in order to make good a course of 016½°(T). The pilot replied to a question asked by the master by explaining that he had to compensate for the west-flowing current. At the time of the approach, an ESE swell was still present despite the light prevailing winds, and the surface current was countered by the ebb current.

16. **Track simulation**

This experiment enabled the verification of the facts collected and the determination of the most probable sequence of events leading up to the grounding.

Mo(A) mid-channel buoy was used as a reference point for this experiment. The landmarks used were the cell and the mole west and east of the port entrance, respectively, and the breakwater east of the mole.

Four alternative track projections were used for the simulation. A position which had been plotted on the chart at 0745 was used as a starting point for the four projections. The wind at the time had been estimated at 3 kn and could thus be considered negligible. The pilot had compensated up to 11.°5 the course to be followed for the drift due to an anticipated residual surface current following a period of easterly winds.

Various currents were thus simulated in the hope of reproducing the ambient conditions as closely as possible.

The currents programmed for each of the projections were

as follows:

Projection number	direction of current	speed of current (kn)
1	000°	nil
2	270°	0.5
3	090°	0.5
4	300°	1.0

The data garnered from the course recorder graph and from the main engine manoeuvres recorded in the log-book proved to be very important. The manoeuvres were simulated from 0745 to 0808, i.e. a few minutes after the grounding, and a computer listing was printed out (see Appendix II).

The geographical position of the shoreline was plotted on the computer printout.

This listing enabled the tracking of the position of the vessel at one-minute intervals for each of the four conditions programmed. The tracks for projections 1 and 3 appeared closest to the actual conditions. This allowed for the conclusion that the easterly component of the current was approximately 0.25 kn. The north-south component remained negligible since the programmed speed of approximately 5 kn was slower than the actual speed of the ship, i.e. approximately 6.6 kn.

Having steered up to 028°(G) to make good a course of 016°½(T), it may be concluded that the effect of the residual surface current due to previous easterly winds was overestimated. In reality the effect of this current, if any, was probably nullified by the start of the ebb-tide.

17. Damage, inspection and repairs

On October 30, an underwater inspection revealed tears and indentations in the forward bottom shell plating as far as starboard tank No. 3 on the starboard side.

At 0434 on November 1, 1987, the "IVAN TEVOSYAN" weighed anchor off Port-Cartier and went alongside the wharf at Pointe-Noire, Quebec at 1038 on the same day. Temporary repairs were made following a comprehensive examination that revealed the following damage:

a) lower forepeak:

- two tears in the bottom shell plating with indentations in way of frames 19 and 20 on the starboard side;

- a tear in the bottom shell plating between frames 20 and 21 in way of the collision bulkhead.

b) starboard fuel oil tank No. 1:

- a tear in way of the collision bulkhead in the forepeak, extending into the fuel oil tank.

c) side tank No. 3

- a tear in the bottom shell plating between frame 30 (the watertight bulkhead separating hold No. 1 from tank No. 3) and frame 42. The tear ran parallel to the starboard bilge strake, approximately 7.5 m away from it.

A marine surveyor from the classification society issued an Interim Certificate of Class on November 6, 1987 on the condition that the "IVAN TEVOSYAN" be reexamined in its unloading port. Furthermore, fuel tank No. 1 and tank No. 3 were taken out of service until such time as the certificate was renewed.

At the end of loading on November 21, 1987, a marine surveyor from the Ship Safety Division of the Canadian Coast Guard issued a Certificate of Fitness to Proceed and allowed the "IVAN TEVOSYAN" to continue on her voyage.

18. Ingress of water

The first indication of bottom damage was air escaping from the ventilation pipes in fuel tanks No. 1 and tank No. 3.

Sounding revealed the presence of leaks in the lower forepeak, fuel tank No. 1 and tanks No. 3 and No. 5. However, it must be noted that the leak in tank No. 5 was not caused by a tear in the bottom shell plating, but rather by a lack of watertightness in the bulkhead separating tanks No. 3 and No. 5.

To deal with the flooding, which caused a starboard list of 2½°, 1,100 tons of liquid ballast were pumped into port tank No. 12 and 52 tons of light fuel were transferred to fuel tank No. 1 in the engine-room on October 30.

19. Risk of pollution

There are two fuel tanks between the peak and the tanks at the forepart of the vessel. Starboard fuel tank No. 1 was the only one containing petroleum, i.e. 52 t of fuel oil. The fuel leak appears to have been negligible, probably because fuel oil is less dense than seawater and because the leak was in the bottom.

20. Discrepancies

According to the master of the "IVAN TEVOSYAN", the exchange of information on the vessel's behaviour and characteristics and the local conditions was quite brief. The pilot claims to be familiar with the sister ships of the "IVAN TEVOSYAN", but he did discuss some of the vessel's characteristics with the navigating personnel, asked the master to confirm his arrival on board with the VTS, and had the "Application to go Alongside" form completed.

After passing the mid-channel buoy, the navigating personnel estimated the speed of the "IVAN TEVOSYAN" at 4-5 kn, while the pilot estimated it at approximately 3 kn.

Between 0749 and 0757 the vessel steered a course of 028°(G). Following this, the course steered was 018°/019°(G) until 0801 when the vessel was steadied up on 025°/026°(G) and she was at a distance of about 3/4 M from the port entrance.

After making visual contact with the harbour installations and realising that it was impossible to bring the vessel back into the channel. The pilot tried to guide the vessel between the mole and the breakwater so as to reduce damage. He remembered giving the order to alter course to port to 020°(G), but seemed to think that the helmsman turned the wheel to starboard. The course recorder graph shows that the ship swung to 021°(G) at 0806. The vessel ran aground at approximately 0807 and swung to starboard to 043°(G) at 0809 due to the transverse thrust of the propeller going astern.

The order to let go both anchors was given at about 0803 and the time at which they were let go was recorded in the log-book at 0805. According to the navigating personnel on the "IVAN TEVOSYAN", 2¼ and 1½ shackles of port and starboard anchor chain were let go, respectively. However, according to the navigating personnel on the "VACHON", only the starboard anchor was let go and

the port anchor was only just awash. This would explain why damage occurred only on the starboard side of the bottom shell plating. Moreover, at the time of the inquiry, the navigating personnel of the "IVAN TEVOSYAN" did not believe that the vessel had run aground.

21. Cause of the incident

Due to contradictory evidence, the cause of the error in navigation is not clear. The tug alerted the vessel that she was steering too far east of the channel alignment. The captain wanted to alter course to port. The last position plotted on the chart at 0805 put the vessel in the approach channel. It must be noted, however, that the previous plot in way of the position at 0805 had been erased. The pilot had completed some 2,700 assignments without incident in Port-Cartier over a period of 8 years. The two cells west of the port entrance were good radar targets and were able to be clearly identified during the approach. The vessel nevertheless ran aground off the breakwater, a result which would be expected, following analysis of the courses steered. The most probable explanation seems to be that the breakwater was confused with the mole, but that this was realized too late due to the radar being on a short-range (1 mile) toward the end of the approach.

22. Qualifications and experience of the "IVAN TEVOSYAN" personnel

The master of the "IVAN TEVOSYAN" has a Soviet Master Mariner's (foreign-going) Certificate issued in March 1972. He completed a pilotage course for large-displacement vessels in Grenoble, France. He has 29 years of sailing experience, including 2 months as master of this vessel, and has been in command for 13 years.

The first mate has a Soviet Deep Sea Navigator Certificate issued in March 1983. He has 14 years of sailing experience, including 2 months on this vessel.

The third officer has a Soviet Short Voyages Navigator Certificate issued in 1984. He has 7 years of sailing experience, including 3 months aboard this vessel.

The port pilot for the Compagnie Minière Québec Cartier has a Certificate of Competency as Master of an Inland Waters Steamship of under 350 tons gross, issued in January 1972. He completed a pilotage course for large-displacement vessels in Grenoble, France. He has 26

years of sailing experience, including 8 years as a pilot in Port-Cartier. He had not undertaken a simulated electronic navigation course in recent years.

The helmsman has a Soviet Certificate of Competency as a 1st Class Able Seaman, issued in May 1984. He has 8 years of sailing experience and 8 years experience as a helmsman.

23. Qualifications and experience of the tug personnel

The master of the tug "VACHON" has a Certificate of Competency as Master of a Home Trade Steamship of under 350 tons gross, issued in May 1976. He has 33 years of sailing experience, including 16 years as master.

The master of the tug "BROCHU" has a Certificate of Competency as Master of a Home Trade Steamship of under 350 tons gross, issued in June 1982. He has 18 years of sailing experience including 5 years as master.

Findings

On October 29, 1987, the Soviet OBO "IVAN TEVOSYAN", assisted by a tug and under the conduct of a Canadian harbour pilot, ran aground in fog at the approaches to the east of the port entrance following and an error in judgement in the vessel's navigation. It appears that the following factors contributed to the grounding.

- the pilot was very familiar with the harbour and did not effectively monitor the progress of the vessel by radar in the poor visibility conditions;
- this was the pilot's fourth pilotage movement since midnight;
- the visibility deteriorated as the vessel approached the harbour, but the vessel continued on her passage;
- the anticipated westward drift did not materialize;
- the warnings given by the masters of the "IVAN TEVOSYAN" and the "VACHON" were not immediately or effectively assessed;
- the radar navigation techniques employed did not permit a continuous assessment of the vessel's position;

- the radar equipment was not employed to the best advantage, in that the range scales latterly used did not permit that a complete assessment of the whole harbour area be made in order to properly identify the harbour entrance; and

- the radar echo of the breakwater was mistaken for that of the mole and the harbour entrance was thus misidentified.

Other Findings

The vessel's position could have been more closely monitored if the "parallel indexing" radar navigation technique had been used.

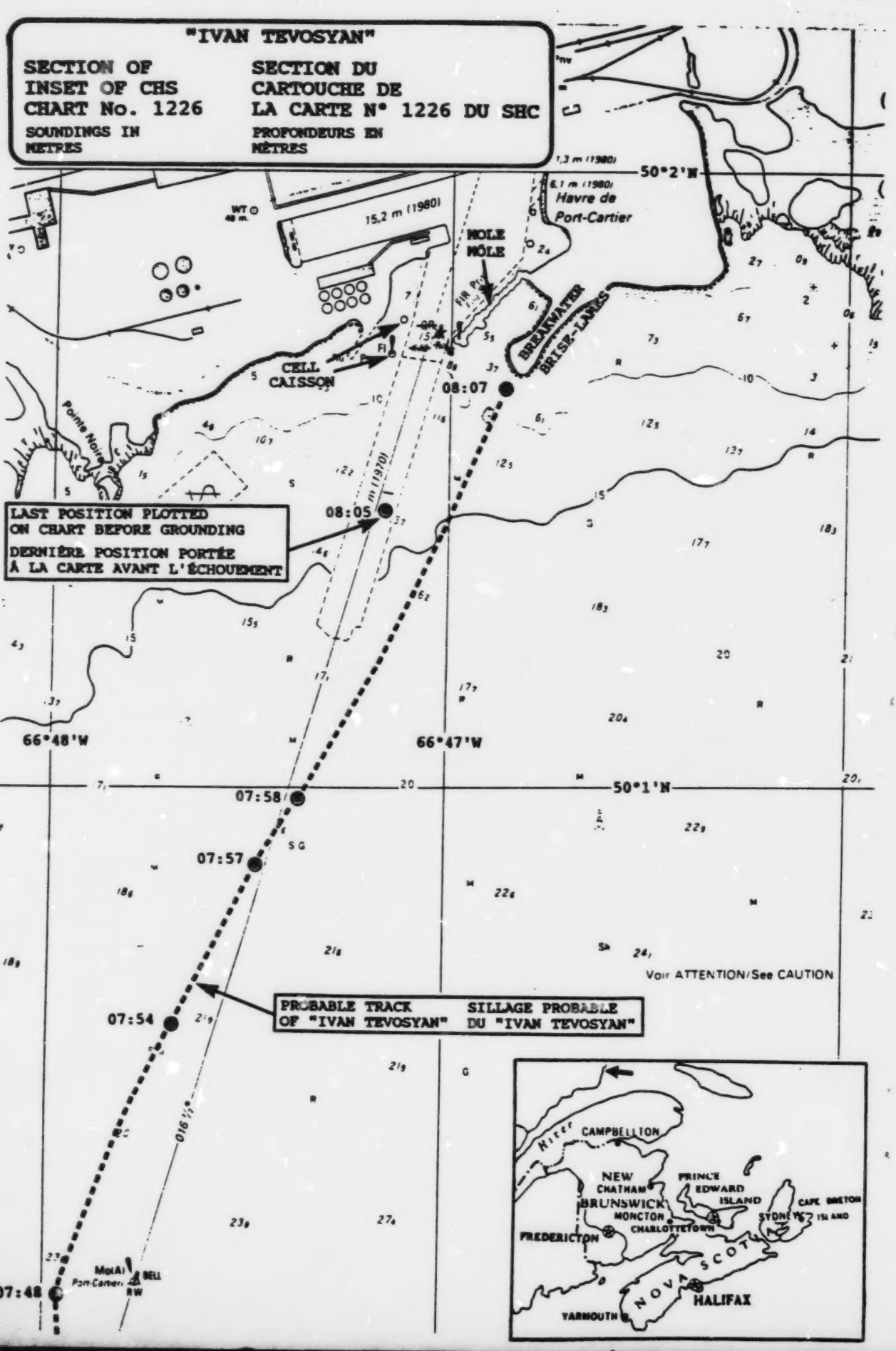
The navigation bearings may have been confused by changing the radar range scale from 4M to 1M too soon.

The anchors of the "IVAN TEVOSYAN" were let go in the hope of slowing the vessel down, but this was carried out too late and the effort had very little effect.

The position of the grounding had not been recorded by the vessel, in her log-book or on her chart, at the time of the inquiry.

The Port Authority had not issued guidelines for ship movements in restricted visibility in its zone.

OTTAWA, ONTARIO
AUGUST, 1988


"IVAN TEVOSYAN"
SECTION OF INSET OF CHS CHART No. 1226
SECTION DU CARTOUCHE DE LA CARTE N° 1226 DU SHC
SOUNDINGS IN METRES
PROFONDEURS EN MÈTRES
50°2'N
Havre de Port-Cartier
MOLE
MÔLE
BREAKWATER
BRISE-LAMES
CELL CAISSON
Pointe Noire
08:07
08:05
LAST POSITION PLOTTED ON CHART BEFORE GROUNDING
DERNIÈRE POSITION PORTÉE À LA CARTE AVANT L'ÉCHOUEMENT
66°48'W
66°47'W
50°1'N
07:58
07:57
07:54
07:48
PROBABLE TRACK OF "IVAN TEVOSYAN"
SILLAGE PROBABLE DU "IVAN TEVOSYAN"
Voir ATTENTION/See CAUTION
CAMPBELLTON
NEW BRUNSWICK
PRINCE EDWARD ISLAND
CAPE BRETON ISLAND
MONCTON
SYDNEY
CHARLOTTETOWN
FREDERICTON
NOVA SCOTIA
HALIFAX
YARMOUTH

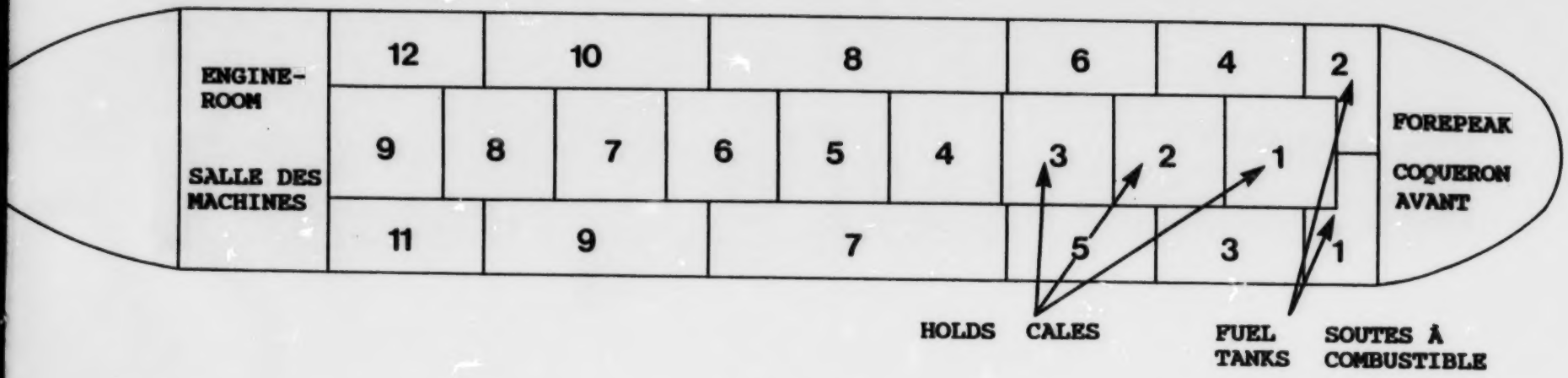
1982

ANNEX I

APPENDICE I

"IVAN TEVOSYAN"

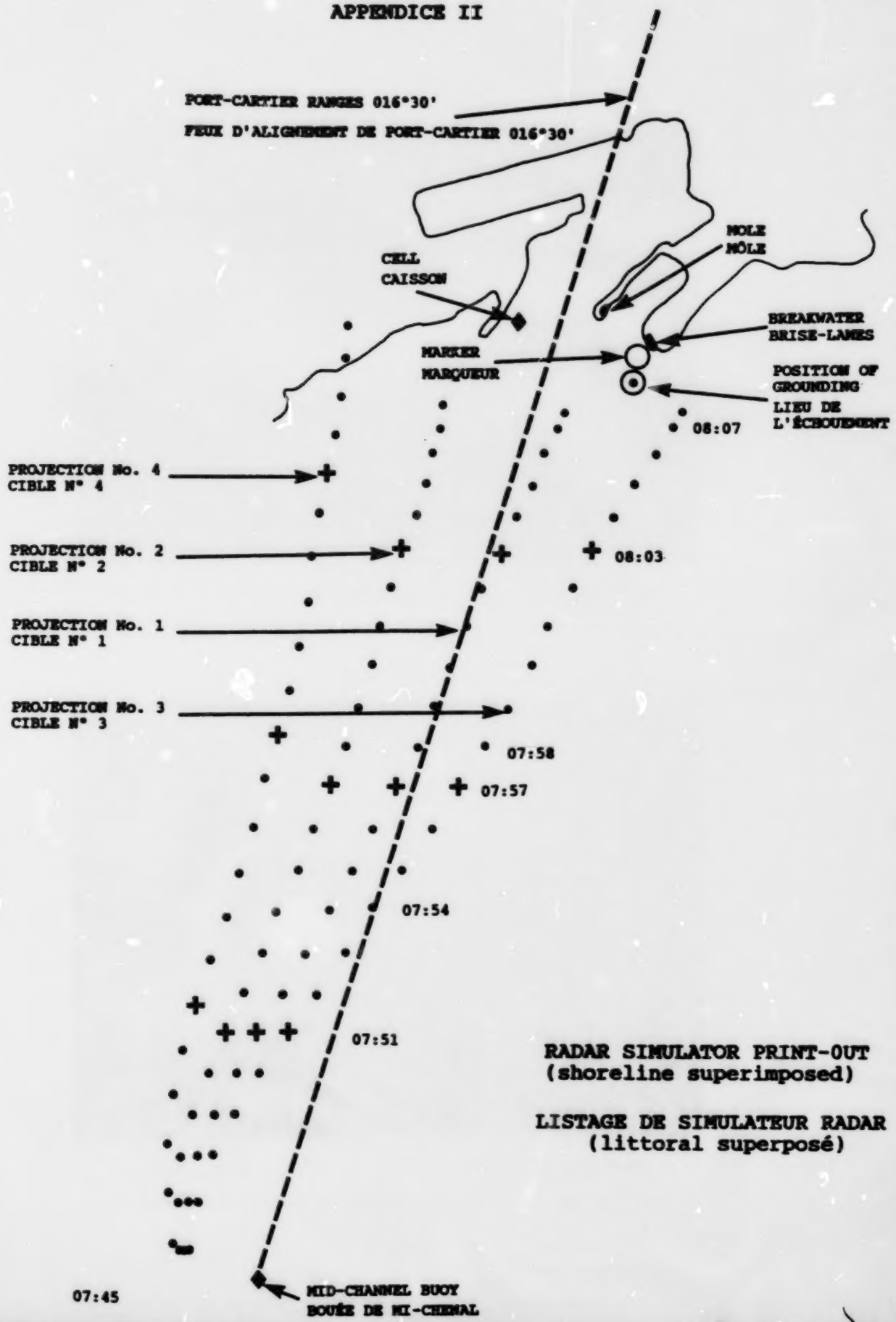
PLAN VIEW VUE EN PLAN



OUTLINE OF GENERAL ARRANGEMENT IS NOT TO SCALE

PLAN D'ENSEMBLE PAS DRESSÉ À L'ÉCHELLE

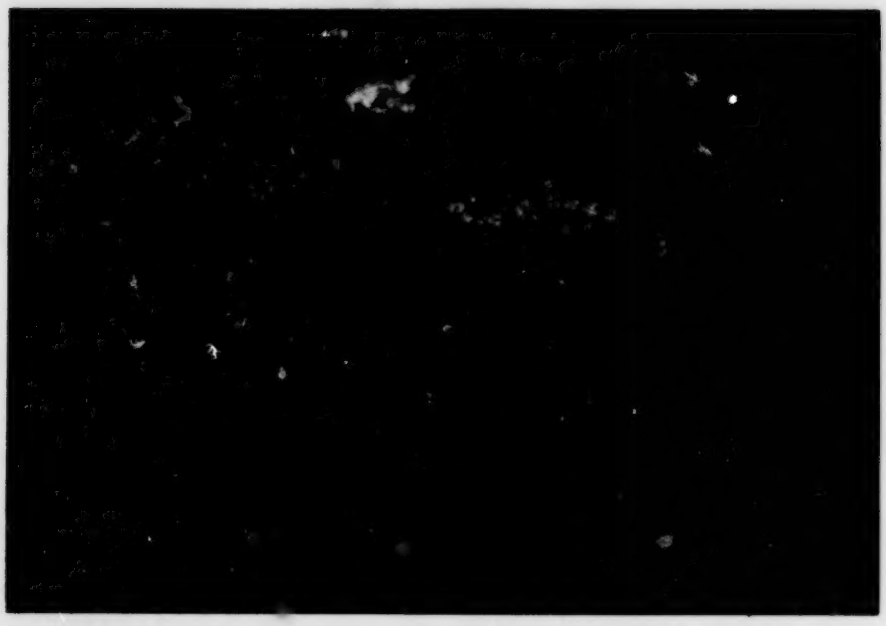
ANNEX II
APPENDICE II



RADAR SIMULATOR PRINT-OUT
(shoreline superimposed)

LISTAGE DE SIMULATEUR RADAR
(littoral superposé)

"IVAN TEVOSYAN" at anchor off Port-Cartier.
Le "IVAN TEVOSYAN" à l'ancrage au large de Port-Cartier.



Section of tear in bottom shell plating.
Partie de la rupture dans le bordé de fond.